Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

U. S. FOREST SERVICE

Pacific Northwest Research Note

FOREST AND RANGE EXPERIMENT STATION · U.S. DEPARTMENT OF AGRICULTURE · PORTLAND, OREGON

PNW-12

April 1964

MORE NATURAL REGENERATION BY CONTROLLING SEED-EATING RODENTS

by

William I. Stein

One way to increase seedling yield from a seed crop is to reduce depredation by seed-eating rodents. At least three methods or combinations thereof might be used to minimize such depredations: (1) reduce small mammal population with poison bait, (2) condition rodents with repellent-treated seed to leave natural seed fall alone, and (3) prepare sites to minimize habitat suitability for rodents. All three approaches still have major limitations and have not been fully evaluated. This note details one successful attempt to protect natural seed fall by reducing rodent population with poison bait.

STUDY AREAS

The study was conducted on two adjacent areas less than one-fourth mile apart in sec. 31, T. 29 S., R. 1 E., Willamette meridian, South Umpqua River drainage, Umpqua National Forest. The areas lie on Acker Divide, a major landform rising east of Tiller, Oreg., between the South Umpqua River and a main tributary to the south, Jackson Creek. Locally, the smaller of the two areas has been called Junction Springs unit 2; the larger, unit 3.

Both areas have comparable elevations ranging from about 3,100 to 3,300 feet. Easy topography on each area includes gentle-to-moderate slopes on several aspects, minor ravines and knolls, and limited low spots of poorly drained soil. Unit 2 is 16.1 acres in size and slopes mainly to the south and southwest. Unit 3 totals 21.8 acres, sloping mainly to the south.

In early 1953, both areas were tractor-logged as part of a timber sale. All merchantable Douglas-fir, grand fir, and incense-cedar were harvested, but all ponderosa and sugar pine were left as seed trees. Residual stand components were as follows:

	Number per acre	Average d.b.h. (Inches)
Unit 2:		
Ponderosa pine	5.1	40.1
Sugar pine	1.9	43.4
Both species	7.0	41.0
Unit 3:		
Ponderosa pine	5.7	33.3
Sugar pine	1.1	39.1
Both species	6.8	34.3

The seed trees varied substantially in size and distribution (fig. 1). D.b.h. of ponderosa pine on unit 2 ranged from 19 to 65 inches, for sugar pine from 17 to 62. For unit 3, comparable values were 13 to 59 inches for ponderosa pine, 13 to 65 for sugar pine. Practically all ponderosa pines were mature, old-growth trees, but the smaller sugar pines were generally immature.

Logging slash was burned on September 2, 1953, after the first soaking rains. Slash was burned early to avoid destruction of seed from the maturing medium cone crop. A successful, relatively complete slash burn was obtained with only partial scorching of a few tree crowns and lower trunks.

RODENT CONTROL

Rodent population on each area was sampled beginning September 9. Fifty large snap traps with modified triggers were selectively placed at about half-chain intervals in two or more lines through each area. Traps were baited with peanut butter and rolled oats. For 3 days they were serviced daily and reset as necessary.

Figure 1.--All pines were left on the areas for seed trees: A, Long, limb-free boles on unit 2 are partially obscured by saplings killed in the slash fire; B, smaller trees were clustered toward the top of the knoll on unit 3.

Results in 150 trap-nights revealed presence of a moderate number of rodents (table 1). Nine mice were caught on each area. There was evidence in sprung traps that several more deer mice escaped, as did one rabbit on unit 3. Not all molesting of traps was by rodents; several were sprung by grasshoppers, and undoubtedly insects removed bait at others.

Table 1.--Daily trapping results for each area before treatment

Trap condition	Unit 2			Unit 3		
	Sept. 10	Sept. 11	Sept. 12	Sept. 10	Sept. 11	Sept. 12
	Number					
Unmolested	41	41	43	34	36	42
Bait eaten, not sprung	2	5	2	12	4	5
Sprung, empty	3	3	1	2	4	2
Deer mouse caught[1/]	4	1	2	2	6	1
Red-backed mouse caught[2/]	0	0	2	0	0	0
Total	50	50	50	50	50	50

1/ Deer mouse, Peromyscus maniculatus.

2/ Western red-backed mouse, Clethrionomys occidentalis.

On unit 2, natural seed fall was protected from rodent consumption with the same successful baiting techniques used in a direct seeding trial the previous year (Stein 1957). These techniques called for an initial baiting to reduce or eliminate resident rodents, followed by one or more rebaitings as rodent activity renewed on the protected area. Renewed activity was detectable by presence of newly hulled seeds from natural seed fall, and by loss of sugar pine seeds placed periodically in acceptance spots located systematically through the unit. Natural seed fall was not protected on unit 3.

Wheat treated with sodium fluoroacetate (1080) was distributed on unit 2 for the first time on September 17. The bait was uniformly distributed in sheltered spots averaging less than 50 feet apart throughout the area and extending about a chain into surrounding uncut timber.

In late November, some pine seeds on unit 2 were eaten by rodents. On December 17, the cutover area only was uniformly rebaited in spots, using thallium-sulfate-treated oats.

Poisoned bait was distributed on unit 2 for the third time on April 15, 1954. In this application, wheat treated with 1080 was broadcast within the cutover. This baiting followed proof of seed removal by rodents as evidenced by substantial depredation of sugar pine seeds in acceptance spots placed April 14 and checked after one night's exposure. Rodent pressure on this seed was heavier on unit 3 than on unit 2, with seeds taken from 31 percent of the spots on unit 3 compared with 22 percent on unit 2. Repeat of seed exposure in acceptance spots the following night showed an even greater difference in depredation between the unprotected and protected units, 46 and 24 percent, respectively. Some seeds were eaten at the acceptance spot, but most were carried off.

SEED FALL

Ten 2- by 3-foot seed traps were placed in each area on September 10 and 11, 1953. Traps were located about 2 chains apart, distributed to achieve the most representative coverage possible for each area. Seed was collected on October 9 and December 17, 1953, and April 16, 1954.

Seed fall on the protected and unprotected area did not differ significantly. Total fall on protected unit 2 numbered 100,098

(S. E. ± 11,573) seeds per acre; on unit 3, seeds per acre numbered 96,307 (S. E. ± 30,731). A majority of seeds on both areas was ponderosa pine:

	Unit 2		Unit 3	
	(Number)	(Percent)	(Number)	(Percent)
Ponderosa pine	78,107	78.0	84,174	87.4
Sugar pine	19,716	19.7	7,583	7.9
Douglas-fir	2,275	2.3	4,550	4.7
Total	100,098	100.0	96,307	100.0

In 1953, most seed fell between October 9 and December 17 (table 2). Ponderosa pine seed fall was slightly later than sugar pine. Douglas-fir produced too few seeds to reveal any trend.

Table 2.--Cumulative total seed fall in the two study areas, by species and dates

Date	Ponderosa pine	Sugar pine	Douglas-fir	Total seed fall per acre
	Percent of yearly total[1/]			Number
Unit 2:				
Oct. 9, 1953	1.0	15.4	0	3,792
Dec. 17, 1953	76.7	100.0	100.0	81,899
Apr. 16, 1954	100.0	100.0	100.0	100,098
Unit 3:				
Oct. 9, 1953	0	20.0	0	1,517
Dec. 17, 1953	71.2	80.0	16.7	66,732
Apr. 16, 1954	100.0	100.0	100.0	96,307

[1/] Not precisely a yearly total since traps were not exposed for the entire year. However, for practical purposes it is a yearly total since any seed falling after mid-April had little chance of germinating in 1954.

Four-fifths of sugar pine seeds caught in the traps and two-thirds of ponderosa pine were sound (table 3). Few Douglas-fir seeds were sound, and the few western hemlock and grand fir seeds found in the traps were so abortive-appearing they were not included in the seed count. Seed soundness was estimated by cutting test from a pooled lot comprising all seeds caught in the seed traps.

Table 3.--Number of seeds caught and percent sound

Species	Seed fall period						Total	
	To Oct. 9		Oct. 9 to Dec. 17		Dec. 17 to Apr. 16			
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Ponderosa pine	1	100.0	157	73.9	56	53.6	214	68.7
Sugar pine	6	33.3	28	89.3	2	100.0	36	80.6
Douglas-fir	0	--	4	25.0	5	0	9	11.1

GERMINATION

In spring 1954, lines of milacre plots were spaced 2 chains apart, north and south across each area. Plots were located at 1-chain intervals within each line, totaling 59 for unit 2 and 72 for unit 3. All seedlings that germinated on the plots in 1954 were counted, and those found alive were marked with wire pins for later reexaminations.

Nearly four times as many seedlings were found on protected unit 2 as on unprotected unit 3 (table 4). A statistical comparison between plots sampled revealed chances were better than 99 out of 100 that seed germination on the two areas was different [1/] Ponderosa pine seedlings were by far the most numerous, 93 and 83 percent, respectively, for unit 2 and unit 3.

1/ Data were handled by analysis of variance to test the hypothesis that populations of seedlings on the two areas did not differ. Since place and treatment variations are confounded, statistical comparisons do not permit expression of results as treatment differences.

Table 4.--Seedling production per acre on the two study areas

Species	Protected unit 2		Unprotected unit 3	
	Number	Percent	Number	Percent
Ponderosa pine	4,169	92.8	1,000	82.8
Sugar pine	288	6.4	167	13.8
Douglas-fir	34	.8	42	3.4
Total	4,491	100.0	1,209	100.0

Seedling return as percent of total seed fall differed by species:

Species	Unit 2	Unit 3
Ponderosa pine	5.3	1.2
Sugar pine	1.5	2.2
Douglas-fir	1.5	.9

The protective value of poisoning to save natural seed fall seems substantiated by relative returns of ponderosa pine, the species present in greatest abundance on both protected unit 2 and unprotected unit 3. Percent returns for sugar pine and Douglas-fir do not show similar results. Infrequent and spotty germination of these two species on both areas raises doubt that valid conclusions could be drawn about the degree of protection afforded sugar pine or Douglas-fir by baiting.

DISCUSSION

In most respects, the two study areas were very similar, yet seedling production was markedly different. Topographically, these areas were as nearly comparable in elevation, exposure, slope, and microrelief as can be found in this terrain. Harvesting and slash burning methods were identical on both areas; quantity of seed fall was similar but differed somewhat in composition. Rodent pressure

prior to seed fall was also comparable. A single major dissimilarity distinguished the two areas--one received poison to control rodents, the other did not. Though not subject to rigid statistical comparison because of confounding effects between treatment and area, a nearly fourfold difference in total germination seems most reasonably explained as the product of the protective treatment applied.

This logical conclusion is further supported by limited evidence from acceptance spots exposed in April 1954. Removal of sugar pine seeds on the first night showed a difference in rodent activity between protected unit 2 and unprotected unit 3--22 and 31 percent of spots disturbed, respectively. Following bait distribution the second day, overnight seed loss showed an even greater difference--24 and 46 percent for units 2 and 3, respectively. These data provide evidence of differences in rodent pressure on the two areas following three successive bait applications. This difference was not evidenced before bait was distributed.

Evidence from several investigations (Hooven 1953, 1955; Stein 1955, 1957) has shown that initial rodent populations are not always completely eliminated following distribution of poison bait. Furthermore, rapid reinvasion of even large areas may also occur (Hooven 1953; Spencer 1951; Spencer 1954). The net aim, then, of a series of baitings on a protected area is to keep the rodent population reduced, thus increasing amount of seed available for germination.

Distributing poison bait to reduce rodent populations and thus gain a greater seedling yield from a seed crop has been tried repeatedly. Partial evaluation of many such efforts gave the impression that some gain in seedling germination had been obtained. However, in most such trials, comparability of seed fall, of rodent population, or of environmental conditions between control and protected areas remained in doubt. Without such comparability, there was always some hesitation to conclude, unequivocally, that seedling gain was the product of rodent population reduction by poison bait. The present study and one by Krauch (1945) on Douglas-fir regeneration in the Southwest appear to demonstrate clearly that substantially more natural regeneration may be obtained by reducing rodent populations by one or more applications of poison bait.

LITERATURE CITED

Hooven, Edward F.

1953. Some experiments in baiting forest lands for the control of small seed eating mammals. Oreg. State Bd. For. Res. Bul. 8, 70 pp., illus.

_____

1955. Midsummer baiting to control seed-eating mammals. Oreg. State Bd. For. Res. Note 22, 4 pp.

Krauch, Hermann

1945. Influence of rodents on natural regeneration of Douglasfir in the Southwest. Jour. Forestry 43: 585-589.

Spencer, Donald A. (comp.)

1951. Investigations in rodent control to advance reforestation by direct seeding. Progress report--spring 1951. U.S. Fish & Wildlife Serv., Wildlife Res. Lab., Denver, Colo., 32 pp., illus.

_____

1954. Rodents and direct seeding. Jour. Forestry 52: 824-826.

Stein, William I.

1955. Some lessons in artificial regeneration from southwestern Oregon. Northwest Sci. 29: 10-22, illus.

_____

1957. A successful direct seeding of sugar pine. U.S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Paper 25, 19 pp., illus.

PSW FOREST AND RANGE EXPERIMENT STATION
JUL 23 1964
STATION LIBRARY COPY